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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/292,186 04/15/99 KINZER D IR-1609-(2-1)

002352 MM21/0814
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EXAMINER

HU, S

ART UNIT

PAPER NUMBER

2811

DATE MAILED:

08/14/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
09/292,186

Applicant(s)
Kinzer

Examiner
Shouxiang Hu

Art Unit
2811



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE three MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on May 29, 2001

2a) ☐ This action is FINAL.

2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 1-13 and 20-22 is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 1-13 and 20-22 is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirements.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☒ The proposed drawing correction filed on Aug 15, 2000 is: a) ☒ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☒ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)

18) ☐ Interview Summary (PTO-413) Paper No(s). _____

16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

19) ☐ Notice of Informal Patent Application (PTO-152)

17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____

20) ☐ Other: _____

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DETAILED ACTION

Claim Objections

1. Claims 2, 4 and 7 are objected to because of the following informalities/defects:

Claims 2 recites the limitation of "said one of the conductivity types" and claim 7 recites the limitation of "said one conductivity type". There is insufficient antecedent basis for either of the limitations in the claims.

The term of "in combination;" recited in claim 4 should read as --in combination,--

Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-13 and 20-22 are rejected under 35 U.S.C. 103(a) as being obvious over Floyd et al. ("Floyd"; 6,090,716).

Floyd disclose a trench-type power MOSFET device (Figs. 1 and 10), each of the trench-type MOSFET comprising: a vertical invertible channel composed of a first

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conductivity type (52) between heavily doped a source region of a second conductivity type (50) and a heavily doped drain region of the second conductivity type (54); gate oxide wall (56), a polysilicon trench gates of the second conductivity type (58A), a source contact (66) in contact with the source region, wherein the layer of the channel material is an epitaxial layer and has a constant concentration along its full length (see Fig. 11).

In the embodiment of Fig. 1 in Floyd, the MOSFET device is an n-p-n polarity type, with the first conductivity type being a p type and the second conductivity type being an n type. Although Floyd does not expressly disclose that the MOSFET device can also be a p-n-p polarity type, it is well known in the art that a MOSFET design which works under one polarity type is normally also workable under the reversed polarity, as evidenced in the prior art such as Floyd et al. (6,069,043; see Figs. 3 and 11) and Darwish et al. (5,674,766; see col. 11, lines 20-22).

Therefore, it would have been well within the ordinary skilled in the art at the time the invention was made to make the MOSFET device of Floyd with the polarity being reversed, so that desired device polarity and improved design flexibility would be achieved.

Regarding claim 3, it is noted that Si is the most widely used semiconductor material.

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Regarding claims 4 and 5, the MOSFET device of Floyd with reversed polarity can inherently have a reduced on resistance and be bidirectional, as it is basically identical to the claimed structure.

Regarding claims 8, 11-13, although Floyd does not expressly disclose that the channel layer can have a resistivity of about 0.17 Ohm-cm and a thickness of about 2.5 um, and that the substrate has a resistivity less than 0.0005 Ohm-cm, it noted that it is old and well known in the art the threshold voltage and the on-resistance of MOSFET are directly correlated to the doping concentrations of the channel layer and the substrate layer; and they are the well recognized parameters of importance subject to routine experimentation and optimization.

Therefore, it would have been obvious to one of ordinary skilled in the art at the time the invention was made to make the MOSFET device of Floyd with the channel layer having a resistivity of about 0.17 Ohm-cm and a thickness of about 2.5 um and the substrate having a resistivity less than 0.0005 Ohm-cm, so that the desired threshold voltage and the on-resistance of the MOSFET would be achieved.

Regarding claims 6 and 20-21, it is noted that it is well known in the art that it is desirable to have a source electrode in direct contact with both of the heavily doped source region and the channel-forming base region through a heavily doped base region for improving the device stability, as evidenced in the prior art, such as in Fig. 12 of Floyd et al. (6,069,043) and in Figs. 1,2 and 4 of Darwish et al. (5,674,766).

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Response to Arguments

4. Applicant's arguments with respect to claims 1-13 and 20-22 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reference B is cited as being related to an MOSFET device.

6. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 or 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ***Shouxiang Hu*** whose telephone number is **(703) 306-5729**. The examiner can normally be reached on Tuesday through Friday from 7:30 AM to 5:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The appropriate fax phone number for the organization where this application or proceeding is assigned is **(703) 308-7724**.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **(703) 308-0956**.

Shouxiang Hu

August 9, 2001

Steven Loke
Primary Examiner

A handwritten signature in cursive script that reads "Steven Loke".